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(54) Title of the Invention: Antifungal and waterproof fabric and a method for its manufacture

(57) Abstract

Purpose:

To ensure the retention over a long period of time of the effect as an antifungal and waterproof fabric

Constitution:

(1) N-n-butylcarbamic acid 3-iodo-2-propynyl ester and (2) one or more compound selected from among the group comprising 2-(4-thiazolyl)benzimidazole, 2-(methoxycarbonyl-amino)benzimidazole, zinc bis(2-pyridylthio-1-oxide) and the like are deposited together with a coating resin on a fabric in a proportion of from 0.01 to 1 g of each per 1 m^2 of fabric.

Effect:

By using the compounds of (1) and (2) conjointly an excellent growth-inhibiting effect on fungi, starting with the Penicillium genus, and an improved washing resistance are achieved with reinforcement of the weaknesses of these agents using a small amount as a whole.

Scope of the Patent Claims

[Claim 1]

An antifungal and waterproof fabric wherein a first component comprising N-n-butylcarbamic acid 3-iodo-2-propynyl ester and a second component comprising one or more compounds selected from among the group comprising 2-(4-thiazolyl)benzimidazole; 2-(methoxycarbonylamino)benzimidazole and its 4,-dodecylbenzenesulfonic acid salt; zinc bis(2-pyridylthio-1-oxide); N-(fluorodichloromethylthio)-phthalimide; N,N-dimethyl-N'-(fluorodichloromethylthio)-N'-phenylsulfamide; dehydroacetic acid and its sodium salt; 2,4,5,6-tetrachloroisophthalonitrile; 2-(4-thiocyanomethylthio) benzothiazole; 2,3,5,6-tetrafluoro-4-(methylsulfonyl)pyridine; 1,2-benzisothiazolin-3-one; and p-chloro-m-xylenol are each deposited to the fabric, together with a coating resin, in a proportion in each case of from 0.01 to 1 g per 1 m^2 of the fabric.

[Claim 2]

A method for the manufacture of an antifungal and waterproof fabric wherein a resin liquid in which have been admixed separately or collectively the aforementioned first and second components is applied to a fabric in such a way that the first and second components are each deposited at a rate of from 0.01 to 1 g per 1 m^2 of the fabric and dried, and then a heat treatment at from 100 to 180°C is carried out.

[Claim 3]

The method for the manufacture of an antifungal and waterproof fabric as disclosed in claim 2 wherein the fabric described in claim 2 is a fabric which has been subjected to a water-repelling treatment.

Detailed Description of the Invention

[0001]

Industrial Field of Application

The invention concerns antifungal and waterproof fabric which has an excellent inhibiting effect against all fungi, and a method for its manufacture.

[0002]

Prior Art

From of old, fabrics have been subjected to antifungal processes in order to eliminate the bacteria and fungi which grow in textile products. Known methods include, for example, the methods in which an antifungal agent containing liquid is applied to the fabric by spraying, coating or dipping, the methods in which an antifungal agent is fixed to the textile surface with a synthetic resin, methods in which an antifungal component is bonded to part of the fiber molecules via an organic silicon compound and quaternary ammonium salt, and the methods in which compounds which contain heavy metals are retained in the fibers themselves.

[0003]

Problems to be Resolved by the Invention

Now, many of the fabrics which are used in waterproof textile products such as raincoats, waterproofing sheets, sportswear, aprons, shower curtains and the like are synthetic fiber products which have polyamide or polyester as the main component. However, these base materials have little affinity for antifungal agents, and even when natural fibers are used in the base materials a loss of the antifungal agent, a reduction in effect and a lowering of quality, for example, arise as a result of the heat treatment which is carried out during the waterproofing process, and the anticipated antifungal effect is frequently not achieved

and improvement in this respect is a long outstanding problem. Thus, the present invention has been realized for the purpose of resolving the problems associated with conventional antifungal and waterproof fabrics and the methods for the manufacture of such fabrics.

[0004]

Means of Resolving These Problems

In order to realize the aforementioned aim, the first invention provides an antifungal and waterproof fabric wherein a first component comprising N-n-butylcarbamic acid 3-iodo-2-propynyl ester and a second component comprising one or more compound selected from among the group comprising 2-(4-thiazolyl)benzimidazole; 2-(methoxycarbonylamino)benzimidazole and its 4-dodecylbenzenesulfonic acid salt; zinc bis(2-pyridylthio-1-oxide); N-(fluorodichloromethylthio)-phthalimide; N,N-dimethyl-N'-(fluorodichloromethylthio)-N'-phenylsulfamide; dehydroacetic acid and its sodium salt; 2,4,5,6-tetrachloroisophthalonitrile; 2-(4-thiocyanomethylthio) benzothiazole; 2,3,5,6-tetrafluoro-4-(methylsulfonyl)pyridine; 1,2-benzisothiazolin-3-one; and p-chloro-m-xylenol are each deposited on a fabric, together with a coating resin, in a proportion in each case of from 0.01 to 1 g per 1 m^2 of the fabric.

[0005]

Furthermore, the second invention provides a method for the manufacture of an antifungal and waterproof fabric wherein a resin liquid in which have been admixed separately or collectively the aforementioned first and second components is applied to a fabric in such a way that the first and second components are each deposited at a rate of from 0.01 to 1 g per 1 m^2 of the fabric and dried, and then a heat treatment at from 100 to 180°C is carried out. This

method for the manufacture of an antifungal and waterproof fabric can be used even with fabrics which have been subjected to a water-repelling treatment. Moreover, in this invention the term fabric does not signify just a base material such as a woven material, knitted material or nonwoven material but also includes textile products such as clothing, everyday products and sports products for example. Furthermore, the term antifungal agent also refers to those which have additional effects such as bactericidal properties as well as antifungal properties.

[0006]

Action and Practical Embodiments

The antifungal and waterproof fabrics of the first invention and the method for their manufacture of the second invention are described in more practical terms by means of respective embodiments. First of all, the materials from which a fungicidal and waterproof fabric of the invention is constituted will be described. The base of an antifungal and waterproof fabric of the first invention is comprised, for example, of synthetic fibers such as polyester, aliphatic or aromatic polyamide, polyacrylonitrile, poly(vinyl alcohol), poly(vinyl chloride) and the like, modified versions of such fibers, natural fibers such as wool, cotton, hemp and the like, and mixtures of two or more types of such fibers. The coating resin which provides the fabric with waterproof properties may be, for example, a thermoplastic resin such as a polyurethane-based resin, polyacrylic resin, poly(vinyl chloride) based resin or poly(vinyl acetate) based resin, or it may be a thermoset resin such as a melamine-based resin or urea resin. These coating resins are generally applied to one side or both sides of the fabric as a single layer or as a multi-layer in an amount of from 2 to 100 g per 1 m^2 of

fabric. There are differences depending on the type and intended use of the fabric, but generally the aforementioned first and second components are applied together with the coating resin at a rate in each case of from 0.01 to 1 g per 1 m^2 of the fabric.

[0007]

These compounds are all highly stable compounds and they have excellent thermal stability in particular, and they are characterized by having a powerful growth inhibiting capacity against hyphomycetes. From among these compounds, the first component, N-n-butylcarbamic acid 3-iodo-2-propynyl ester, has an excellent growth inhibiting effect against all of the fungi which grow on textiles and it also has a high affinity with the fibers, and it is the most desirable antifungal agent. However, a tendency for loss is seen in the heat treatment which is carried out during the waterproofing process. Consequently, an inadequate effect is seen against some organisms of the Penicillium genus. There is a method in which the amount of the agent which is being used is increased to counteract this effect, but if more than 1 g per 1 m^2 of the fabric is used then a yellow discoloration often appears as a result of the heat treatment. Moreover, a satisfactory effect is not observed if the amount added is less than 0.01 g/m^2.

[0008]

Furthermore, all of the second component chemicals have a growth inhibiting effect of some extent against almost all of the general types of fungi. However, by using them conjointly with the first component as a whole an increase is seen in the growth inhibiting action against the Penicillium genus. Some of the second component compounds have poor washing resistance because of their inadequate affinity with

synthetic fibers, but by using them conjointly with the first component they make up for the weaknesses of each other and the effect as an antifungal and waterproof fabric can be maintained effectively over a long period of time. Other additives may be added to the coating resin within ranges such that the intent of the invention is not lost.

[0009]

Next the second invention, a method for the manufacture of an antifungal and waterproof fabric, will be described. The base material of the fabric which is used in the second invention corresponds to the base material of the antifungal and waterproof fabric in the first invention described above. In order to impart waterproof properties to the fabric, the coating resin described in the first invention is dissolved in an organic solvent such as xylene, toluene, methyl ethyl ketone, dimethylformamide or the like, or emulsified or suspended in an aqueous solution, to provide a waterproofing agent solution. Moreover, the aforementioned first and second components are admixed in their original powder-like or liquid form, or in an organic solvent, for example, and surfactants and antioxidants, for example, are admixed, as required, with the coating resin to prepare the coating liquid. The amounts of the first and second components which are used conjointly which should be deposited to the fabric are determined by the intended use and the type of fabric, but they are generally from 0.01 to 1 g in the case of each component per 1 m^2 of the fabric.

[0010]

The first component, the second component and the coating resin may be applied to the fabric after preparing a composition in which the whole of the prescribed amounts of all of the components which are to be deposited on the fabric

have been mixed together, or the first and second components may be mixed with part of the coating resin and coated and dried and then the remainder of the coating resin which does not contain antifungal agent may be coated over the top and dried, or coating resin which does not contain antifungal agent and coating resin which does contain antifungal agent may be coated in the reverse order and dried. The first and second components may be mixed with coating resin separately and then one coating liquid can be coated and dried and then the remaining coating liquid can be coated on the surface and dried. The prepared coating liquids can be coated on the fabric with dry or wet coating methods with a coating system such as a knife coating system, a roll coating system, and dip-nip system, an immersion system or a spray system for example. Moreover, a water-repelling treatment in which the fabric is dipped in a water-repelling agent or in which a water-repelling agent is applied to one side of the fabric can be carried out with a view to preventing the fabric from generally becoming wet with water such as rain, for example, but there is no limitation to such a process. After the coating liquid has been applied the fabric is dried at from 50 to 160°C. After drying, the fabric is heat-treated at from 100 to 180°C for from 10 to 200 seconds and the resin is spread and retained. In this case, the spreading is inadequate if the heat treatment temperature is below 100°C while on the other hand the antifungal agent is dissipated, or thermally degraded and the fabric may be discolored, or problems with quality may arise, if the heat treatment temperature exceeds 180°C.

[0011]

Furthermore, in this invention other additives may be

added within the range where the scope of the invention is not lost when preparing the first component, second component and coating resin liquids. Moreover, the first and second components may be micro-encapsulated in the original powder or liquid form or in the form of a mixture with a solvent, with the addition of improving agents such as antioxidants and stabilizers, for example, as required, or they may be adsorbed on a porous solid powder, for compounding with the coating resin. This can provide some improvement in terms of slow-release properties, weather resistance properties, heat resistance properties and the like.

[0012]

Illustrative Examples

Examples of the invention are described in practical terms and compared using various tests with comparative examples. Moreover, unless there is some indication to the contrary, the terms "%" and "parts" are on a "by weight" basis, and the term g/m^2 is based on the area of the coated surface of the fabric. First of all the methods used for evaluation purposes in each of the examples will be described.

(1) Washing Method: JIS L 0127-103

(2) Antifungal Tests:

Organisms Supplied:

Aspergillus niger (referred to hereinafter as AN)

Penicillium citrinum (referred to hereinafter as PC)

Cladosporium cladosporioides (referred to hereinafter as CC)

Alternaria alternata (referred to hereinafter as AA)

Test method: JIS Z 2911

Culture Medium: JIS Irish potato/agar culture medium base (referred to hereinafter as PDA culture medium) was used and a 25 x 25 mm sample cloth was stuck on and incubated.

[0013]

The incubation was carried out at 28°C for from 7 to 14 days.

Assessment Criteria:

1: Growth on more than one third of the fabric sample

2: Growth over not more than one third of the fabric sample

3: No growth at all

Furthermore, the meanings of the abbreviations used in the examples and in the tables are indicated below.

[0014]

First Component

BCP: N-n-butylcarbamic acid 3-iodo-2-propynyl ester

Second Component

BIT: 1,2-Benzisothiazolin-3-one

DFA: N,N-Dimethyl-N'-(fluorodichloromethylthio)-N'-phenylsulfamide

DHA: Dehydroacetic acid

DHAS: Dehydroacetic acid sodium salt

FMP: N-(Fluorodichloromethylthio)phthalimide

MBC: 2-(Methoxycarbonylamino)benzimidazole

MBCS: 2-(methoxycarbonylamino)benzimidazole 4'-dodecylbenzene sulfonic acid salt

PCMX: p-Chloro-m-xylenol

TBZ: 2-(4-Thiazolyl)benzimidazole

TCIPN: 2,3,4,5-Tetrachloroisophthalonitrile

TCMP: 2,3,5,6-Tetrachloro-4-(methylsulfonyl)pyridine

TCMTB: 2-(4-Thiocyanomethylthio)benzothiazole

ZPT: Zinc bis(2-pyridylthio-1-oxide)

Example 1 and Comparative Example 1

Antifungal and waterproof fabrics were manufactured using the method for the manufacture of antifungal and waterproof fabrics of this invention using dyed polyamide

woven materials with 70 denier warp threads and 70 denier weft threads with (warp x weft) 120 x 90 threads per inch) and their antifungal properties were investigated. First of all a coating liquid comprising 80 parts Hydran HW-111 (manufactured by the Dainippon Ink Co.) and 20 parts Hydran HW-140 (manufactured by the Dainippon Ink Co.) was prepared. Some of this coating liquid was stored as a blank sample. The remaining coating liquid was divided into eleven parts, and to seven of these parts were added a 3-methoxybutanol solution which contained 30% BCP as the first component of this invention and TBZ powder (purity about 99%) as the second component in such a way that on coating the coating liquid at a rate of 30 g/m^2 the amounts deposited were as shown in Table 1. Separately, as comparative examples, the first component or the second component was added individually to the remaining coating liquids in such a way that the amounts deposited were as shown in Table 1. Twelve pieces of the aforementioned dyed polyamide textile were used and these were each coated using a knife coater with one of the abovementioned twelve types of coating liquid, including the blank sample, in such a way that the coated weight was 30 g/m^2. After coating, all of the samples were heat treated for 30 seconds at 160°C and twelve sample fabrics were obtained. These sample fabrics were maintained at 28°C and incubated for 14 days, using the PDA culture medium in each case, in an antifungal properties test. The results are shown in Table 1.

[0015]

Table 1

	Amount of Antifungal Agent Deposited (g/m^2)		Antifungal Effect			
	BCP	TBZ	AN	PC	CC	AA
Blank	-	-	1	1	1	1
Example 1	0.02	0.02	2	2	2	1
	0.02	0.1	2	2	2	1
	0.05	0.02	2	2	3	2
	0.05	0.1	2	3	3	2
	0.08	0.06	3	3	3	2
	0.08	0.1	3	3	3	2
	0.2	0.06	3	3	3	3
Comparative Example 1	0.08	-	3	2	3	2
	0.2	-	3	2	3	3
	0.4	-	3	3	3	3
	-	0.4	3	3	3	1

It is clear from these results that with BCP alone the effect against PC is rather poor and with TBZ alone the effect against AA is weak. However, an increase in potency is observed on using BCP and TBZ conjointly and even with small amounts of the first and second components it is clear that there is an excellent inhibiting effect against each of the organisms.

[0016]

Comparative Example 2

The antifungal effects when the first component or a second component used in the invention or apatite silver which has been widely used in the past and was used in the first and second components of this invention, were each used alone with the same dyed polyamide textile used in Example 1 were investigated. BCP from the first component, TBZ (a powder of purity about 99%), DHAS (a powder of purity about 99%) and apatite silver (a powder containing 3% silver) from among the second components were deposited independently in varying amounts. In all other respects the fabrics were processed in the same way as in Example 1 and they were evaluated in the same way as before. The results are shown

in Table 2.

[0017]

Table 2

	Antifungal Agent	Amount Deposited g/m^2	Antifungal Effect				Remarks
			AN	PC	CC	AA	
Comparative Example 2	None	-	1	1	1	1	
	BCP	0.1	3	2	3	2	
		0.3	3	3	3	3	
		0.5	3	3	3	3	Slight yellowing
	TBZ	0.3	2	3	3	1	
		0.5	3	3	3	1	Yellowing
	DHAS	0.5	1	2	2	1	Yellowing
		1.0	2	2	3	1	Yellowing
	Apatite Silver	1.0	1	1	1	1	
		2.0	1	1	1	1	

It is clear from Table 2 that when BCP is used alone the growth of each of the organisms is inhibited more or less completely if more than 0.3 g/m^2 is deposited and there is some effect with the deposition of 0.1 g/m^2. It is clear that this is more potent than TBZ or DHAS with which a powerful inhibiting effect on fungi has been seen in the past. However, the amount which must be deposited is large when compared with the present invention as used in Example 1. With apatite silver the potency against the organisms was low. With these agents a tendency for yellowing of the treated fabric on heat treatment at 150°C was seen when the treated concentration was high.

[0018]

Example 2

The heat treatment conditions after coating the coating liquid in the method for the manufacture of a fungicidal and waterproof fabric of this invention was varied and the effect of this variation was evaluated. Thus, sample fabrics on which 0.08 g/m^2 of BCP and 0.06 g/m^2 of TBZ had been deposited from among the sample fabrics produced in Example 1

were produced with different heat treatment conditions after coating, and fungal growth inhibition tests were carried out. The results are shown in Table 3. From this table it is clear that the agents are lost as the heat treatment temperature is increased. It is preferable for the heating time to be as short as possible.

[0019]

Table 3

	Heat Treatment Conditions		Antifungal Effect					
			AN		PC	CC	AA	
	°C	Seconds	7 Days	14 Days	14 Days	14 Days	7 Days	14 Days
	No Antifungal Agent No Heat Treatment		1	1	1	1	1	1
	No Heat Treatment		3	3	3	3	3	3
Example 2	180	30	2	1	2	2	1	1
	160	30	3	3	3	3	3	3
	160	90	2	2	3	3	2	2
	160	120	2	1	3	3	1	1
	140	30	3	3	3	3	3	3
	140	90	3	3	3	3	3	2

Example 3

Antifungal and waterproof fabrics of this invention were produced using the method for the manufacture of an antifungal and waterproof fabric of this invention using the same dyed textile material as in Example 1 with the conjoint use of BCP as the first component and one type of second component selected from among TBZ, MBC, MBCS, ZPT, FMP, DFA, DHA, DHAS, TCIPN, TCMTB, TCMP, BIT and PCMX. The coating liquids were compounded, prepared and coated in the same way as in Example 1 in such a way that both the first component and the second component were deposited at rates of 0.1 g per 1 m^2 of the fabric. After coating, a heat treatment at 150°C for 30 seconds was carried out and antifungal and waterproof fabrics were obtained. The fabrics obtained in this way were evaluated in terms of their antifungal properties. The

results are shown in Table 4.

[0020]

Table 4

	Antifungal Agent		Antifungal Effect			
	First Component (0.1 g/m^2)	Second Component (0.1 g/m^2)	AN	PC	CC	AA
	-	-	1	1	1	1
Example 3	BCP	TBZ	3	3	3	3
	BCP	MBC	3	3	3	3
	BCP	MBCS	3	3	3	3
	BCP	ZPT	3	3	3	3
	BCP	FMP	3	3	3	3
	BCP	DFA	3	3	3	3
	BCP	DHA	3	3	3	3
	BCP	DHAS	3	3	3	3
	BCP	TCIPN	3	3	3	3
	BCP	TCMTB	3	3	3	3
	BCP	TCMP	3	3	3	3
	BCP	BIT	3	3	3	3
	BCP	PCMX	3	3	3	3

On comparing the results of table 4 with those of Comparative Example 2 it is clear that the antifungal and waterproof fabrics of this invention in which the first and second components are used conjointly have the effect of inhibiting the growth of the various organisms even when the total amount of the chemical agents used is small.

[0021]

Example 4 and Comparative Example 3

An antifungal and waterproof fabric of this invention was washed and the washing resistance was evaluated and compared with that of a comparative example. First of all the same polyamide textile material as used in Example 1 was immersed in a water-repelling agent liquid which contained 5% Asahiguard AG710 (manufactured by the Asahi Glass Co.) and 2% isopropyl alcohol and wrung out with a mangle in such a way that the pick-up was 30% and then dried for 2 to 3 minutes in a hot draught at from 140 to 150°C. A coating liquid was prepared by mixing a 3-methoxybutanol solution which

contained 30% BCP and TBZ powder in a solution comprising 3 parts Kurispon P1018A (manufactured by the Dainippon Ink Co.) and 30 parts xylene and coated using a knife coater at a rate of 30 g/m^2 so as to deposit on the fabric 0.3 g/m^2 of BCP and 0.08 g/m^2 of TBZ and then the fabric was heat treated at 150°C for 39 seconds. The antifungal and waterproof fabric of this invention produced in this way was washed five times and the antifungal properties before and after washing were compared. The results are shown as Example 4 in Table 5. Moreover, fabric for comparative testing was produced in just the same way as in Example 4 except that the BCP and TBZ powder were not added to the coating liquid, and an antifungal test was carried out. The results are shown as Comparative Example 3 in Table 5.

[0022]

Table 5

		Washing	Antifungal Effect			
			AN	PC	CC	AA
Example	4	Before	3	3	3	3
		After	3	3	3	3
	5	Before	3	3	3	3
		After	3	3	3	3
	6	Before	3	3	3	3
		After	3	3	3	3
Comparative Example	3	Before	1	1	1	1
	4	Before	1	1	1	1
	5	Before	1	1	1	1

Example 5 and Comparative Example 4

An antifungal and waterproof fabric of this invention was produced using the method for the manufacture of an antifungal and waterproof fabric of this invention with a polyester textile and this was then washed and the washing resistance was evaluated and compared with a comparative example. First of all a polyester textile material with

50 denier weft threads and 50 denier warp threads of density (warp x weft) 110 x 80 threads per inch was dyed using a disperse dye. This fabric was immersed in a water-repelling agent solution which contained 5% Asahiguard LS317 (manufactured by the Asahi Glass Co.) and 2% isopropyl alcohol and wrung out with a mangle in such a way that the pick-up was 30% and then dried for 2 to 3 minutes in a hot draught at from 140 to 150°C. A coating liquid comprising 100 parts Kurispon 4010 (manufactured by the Dainippon Ink Co.), 3 parts Kurispon NX (manufactured by the Asahi Glass Co.), 0.5 parts Bekkamin P-138 (manufactured by the Dainippon Ink Co.). 15 parts of toluene and 15 parts of methyl ethyl ketone was coated on the fabric using a knife over-coater at a rate of 120 g/m^2 and dried in such a way that no bubbles were produced at from 80 to 100°C. Moreover, a 3-methoxybutanol solution which contained 30% BCP and TBZ powder were compounded with a coating liquid comprising 50 parts Kurispon 6116SL (manufactured by the Asahi Glass Co.), 50 parts Kurispon NB765 (manufactured by the Asahi Glass Co.), 30 parts methyl ethyl ketone and 30 parts dimethylformamide in such way that the amounts deposited after coating were BCP 0.4 g/m^2 and TBZ 0.1 g/m^2. This coating liquid was coated using a knife coater onto the aforementioned fabric which had been coated and dried at a rate of 30 g/m^2 and then the fabric was heat treated at 150°C for 39 seconds. The antifungal and waterproof fabric of this invention produced in this way was washed five times and the antifungal properties before and after washing were compared. The results are shown as Example 5 in Table 5. Moreover, fabric for comparative testing was produced in just the same way as in Example 5 except that the BCP and TBZ powder were not added to the coating liquid and an antifungal test was

carried out. The results are shown as Comparative Example 4 in Table 5.

[0023]

Example 6 and Comparative Example 5

A wet coating method was used in this example. The same dyed polyamide textile material as used in Example 1 was immersed in a water-repelling agent liquid which contained 1.5% Asahiguard AG710 (manufactured by the Asahi Glass Co.) and 2% isopropyl alcohol and wrung out with a mangle to a pick-up of 30% and dried for 2 to 3 minutes in a hot draught at from 140 to 150°C to complete the water-repelling treatment. Moreover, a coating liquid was prepared by adding 3-methoxybutanol solution which contained 30% BCP and TBZ powder to a liquid mixture comprising 100 parts Kurispon MP-829 (Manufactured by the Dainippon Ink Co.), from 5 to 10 parts DIC Color (manufactured by the Dainippon Ink Co.), 3 parts Asahiguard LS-317 (manufactured by the Asahi Glass Co.), 3 parts Parnock D-500 (manufactured by the Dainippon Ink Co.) and 20 parts dimethylformamide in such a way that after coating the deposition rates were BCP 0.8 g/m^2 and TBZ 0.2 g/m^2. This coating liquid was coated at a rate of 120 g/m^2 on the fabric which had been subjected to the aforementioned water-repelling treatment and then coagulated for 5 minutes in a 5% dimethylformamide gelling bath and soaked for 20 minutes in a hot water bath at 40°C. Moreover it was then wrung out with a mangle and dried with a hot draught at from 100 to 120°C and then thermal setting was carried out for 30 seconds at 150°C. The antifungal and waterproof fabric of this invention so obtained was washed five times and the antifungal properties before and after washing were compared. The results are shown as Example 6 in

Table 5.

[0024]

Moreover, fabric for comparative testing was produced in just the same way as in Example 6 except that the BCP and TBZ powder were not added to the coating liquid, and an antifungal test was carried out. The results are shown as Comparative Example 6 in Table 5. In comparison with the fabrics produced in Comparative Examples 4 and 5, the antifungal and waterproof fabrics of this invention produced in Examples 5 and 6 were both better able to inhibit the growth of the various organisms. Furthermore, the effect persisted after washing.

[0025]

Effect of the Invention

Each of the agents cited for the first and second components which are used in an antifungal and waterproof fabric of this invention has a growth inhibiting effect of some extent against all the fungi in general. However, by using the first and second components conjointly an excellent growth inhibiting against fungi starting with the Peniciillium genus is achieved with the use overall of a small amount. Among the agents cited for the second component there are some which have poor washing resistance because they have inadequate compatibility with synthetic fibers, but by using these conjointly with the first component the weaknesses of both are overcome and it is possible for the effect as a fungicidal and waterproof fabric to be retained over a long period of time.